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AUTHOR Olech, Carol A.
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ABSTRACT

This study examined the relationship between elementary teachers' pedagogical beliefs and the level of their instructional computer use. Participating teachers had 2 years of experience using a computer network that provided students with an integrated learning system, several word processing packages, desktop publishing, a multimedia encyclopedia, and a presentation program. Teachers completed a 57-item questionnaire that assessed the criterion variable, level of computer use, and several independent variables (pedagogical orientation, innovativeness, computer relevance, computer self-competence, and subjective norms). One of the scales assessed pedagogical orientation and categorized teachers as having behaviorist, information-processing, or constructivist beliefs. Findings indicated that teachers were eclectic in their pedagogical orientation. There was a negative correlation between behaviorist beliefs and level of computer use. Teachers who embraced an information-processing pedagogy had a significantly higher level of computer use than did their behaviorist counterparts. Constructivist teachers' level of computer use was slightly less than that of the information-processing teachers, but was not significantly different from either the behaviorist or information-processing group. Once the personal variables of the teacher were used to predict level of computer use, the pedagogical orientation did not significantly contribute to the prediction of the model. Recommendations were made for the refinement of the questionnaire and for continued research in the relationship between teachers' pedagogical beliefs and instructional computer use. (Contains 20 references.) (Author/SM)

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Abstract

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The relationship between the pedagogical beliefs of teachers and the level of instructional computer use was studied. The sample was composed of 101 elementary teachers who have had two years of experience using a computer network that provided students the opportunity to use an integrated learning system, several word processing packages, desktop publishing, a multimedia encyclopedia and a presentation program. Teachers completed a 57-item questionnaire that assessed the criterion variable, level of computer use and several independent variables including: pedagogical orientation, innovativeness, computer relevance, computer self-competence and subjective norms. One of the two scales developed for this study assessed pedagogical orientation and categorized teachers as having behaviorist, information processing, or constructivist beliefs depending on how they responded to issues related to knowledge acquisition and the nature of knowledge. The other scale was a composite of new and previously used items to measure level of computer use along a continuum from utilization to integration based on the Rieber and Welliver (1989) Model of Instructional Transformation.
Findings indicated that teachers were eclectic in their pedagogical orientation. There was a negative correlation between behaviorist beliefs and level of computer use. Teachers who embraced an information processing pedagogy had a significantly higher level of computer use than their behaviorist counterparts. The level of computer use of the constructivist teachers was slightly less than that of the information processing teachers', but was not significantly different from either the behaviorist or information processing group. Once the personal variables of the teacher (i.e., innovativeness, computer relevance, computer self-competence and subjective norms) were used to predict level of computer use, the pedagogical orientation did not significantly contribute to the prediction of the model.
Recommendations were made for the refinement of the questionnaire and for continued research in the relationship between teachers' pedagogical beliefs and instructional computer use.

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THE RELATIONSHIP BETWEEN TEACHERS' PEDAGOGICAL BELIEFS AND THE LEVEL OF INSTRUCTIONAL COMPUTER USE

By Carol G. Olech

Introduction

As we approach the year 2000, a daily theme of the popular media is the impending disaster that may be the result of the "millennium bug." The message being conveyed is that our society has become so utterly dependent on computers, few aspects of our life would be unaffected by the inability of computers to carry out their normal functions. Yet little, if anything, has been published about how the incapacity of computers would effect instruction in the nation's classrooms. Perhaps journalists have recognized what educational researchers have repeatedly concluded; computers have not substantially changed the way teaching and learning take place in our schools (Becker, 1991b; General Accounting Office, 1995; Goodlad, 1983, Office of Technology Assessment, 1988).

Cuban (1986) pointed out that as new technologies are diffused into schools, the teacher acts as the gatekeeper to the classroom. As gatekeeper, the teacher has the ability to decide which innovations are admitted into the classroom, how fully they are incorporated into the daily classroom routine, and which are entirely excluded (Cuban, 1986). Thus, in the gatekeeper role, the teacher becomes a variable that merits study.

The present study was conducted to consider why some teachers integrate computers into their instructional program while others do not. It was an extension of two diverse strands of research. Each of these strands considered the teacher variable and the implementation of computer technology into instruction. The first strand investigated the

personal characteristics that were predictive of computer use. The second strand was concerned with the pedagogical beliefs of teachers associated with computer use.

Marcinkiewicz (1993, 1994) was responsible for developing a rather well defined profile of a computer-using teacher. Marcinkiewicz tested a number of personal variables as possible predictors of computer use. In order to carry out this work, Marcinkiewicz recognized that computer use was too complex to be operationally defined along a use/non-use dichotomy. Based on the Rieber and Welliver (1989) Model of Instructional Transformation, Marcinkiewicz and Welliver (1993) developed an instrument that categorized teachers into three groups according to their level of instructional computer use. Those levels were non-use, utilization, and integration. The threshold that marked the passage between utilization and integration was the teacher's perception that if computers were no longer available, on-going classroom practices could not be carried out without disruption.

Using this instrument, Marcinkiewicz (1993, 1994) found four variables that were associated with computer use. These variables included:

- the personal innovativeness of the teacher
- the degree to which the teacher perceived the computer to be relevant to teaching
- the self-competence of the teacher for using the computer
- the degree to which the teacher perceived computer use to be expected of him or her by the significant others in the school setting (subjective norms).

The second strand of research investigated the relationship between teachers' pedagogical beliefs and computer use. Several researchers have advanced the notion that

teachers can be characterized according to their view of how students learn (Duffy & Jonassen, 1991; Hannafin & Savenye, 1993). Some teachers believe that learning is a matter of transferring knowledge from outside to within the learner. This has been labeled an "objectivist" view of learning. Other teachers tend to see knowledge as a creation of the learner as the learner imposes meaning on experience. Supporters of this view were characterized as "constructivists" (von Glasersfeld, 1988).

Because the objectivist educator is concerned with the most appropriate delivery of the curriculum to the learner, he or she might value the computer for its ability to provide students with individualized instruction and immediate reinforcement. Drill and practice software and tutorials, along with more comprehensive integrated learning systems might interest the objectivist educator (Niederhauser and Stoddart, 1994). By contrast, a constructivist teacher would value the computer's ability to provide students with the tools to organize and explore their world. Productivity tools similar to those in use by the general public, such as word processing, desktop publishing, presentation programming, and information access through the Internet would have the most appeal to the constructivist educator (Hannafin & Freeman, 1995; Niederhauser & Stoddart, 1994).

Becker (1991a) suggested that when objectivist computer applications were used, they produced only moderate results in terms of pupil achievement. He believed that a more powerful use of computers in education involved those applications that tapped the information access capabilities of the computer. Hannafin and Savenye (1993) indicated that the more constructivist applications of the computer required a shift in the role of the teacher from the traditional dispenser/manager of information to the role of facilitator and

coach. Hannafin and Savenye suggested that the reason computers were not being fully adopted is because teachers are uncomfortable with the role they must adopt in a constructivist learning environment, rather than because of any resistance to the computer per se.

Hannafin and Freeman (1995) investigated the question of whether teachers who embraced a constructivist pedagogy were more likely to use computers for instruction. The researchers found no clear relationships between the views teachers held about learning and the likelihood that they would use computers in instruction.

In the Hannafin and Freeman (1995) study, the teachers in the sample were considered either objectivists or constructivists based on their beliefs regarding the nature of knowledge. However, as Driscoll (1994) noted, the objectivist point of view actually embodied two diverse positions on learning. Driscoll defined behaviorism and information processing as two separate orientations toward learning that shared the objectivist view.

The current study was based on the assumption that there are two issues surrounding learning upon which pedagogical positions are divided. Because of the divergent positions teachers can take on these two issues, three views of learning can be defined. The first issue concerns the nature of knowledge giving rise to two opposing views, objectivism and constructivism. Objectivism holds that knowledge exists apart from the knower. Coming to know involves forming ever-closer approximations to objective reality. Behaviorism and information processing theory form two objectivist orientations

(Driscoll, 1994). The opposing view, constructivism, holds that knowledge is created as the learner imposes meaning on experience.

The second issue surrounding learning theory concerns the means by which knowledge is acquired. One opinion stresses the behavioral aspect of knowledge acquisition; the other opinion stresses a cognitive approach. Behavioral approaches emphasize the role of the connection between the stimulus, response and reinforcement. Practice and reinforcement are important means of strengthening learner response (Driscoll, 1994; Gredler, 1992). While behavioral approaches stress events external to the learner as critical to the learning process, cognitivism, the alternate view of knowledge acquisition, emphasizes the role of mental processes as the learner actively relates new inputs to prior knowledge, noting similarities and differences (Gredler, 1992). Both information processing and constructivism can be viewed as cognitive theories. Figure 1 is provided to illustrate how orientations toward the nature of knowledge and knowledge acquisition gave rise to three learning theory positions.

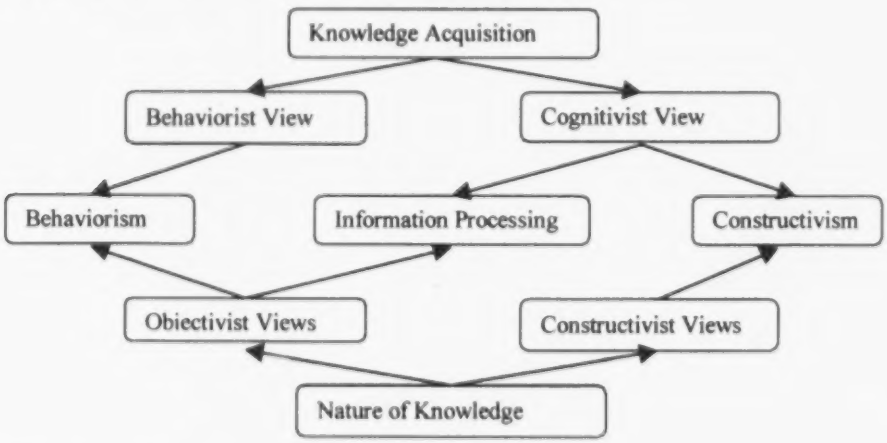

Figure 1 Three Learning Theory Positions

The present study was conducted to investigate the relationship between teachers' pedagogical beliefs regarding the nature of knowledge and knowledge acquisition and the level of computer use they achieve in their classrooms. Teachers' beliefs regarding behaviorism, information processing and constructivism were considered. Also investigated was whether the personal characteristics of teachers that were found by Marcinkiewicz (1993, 1994) to be predictive of the level of computer use remained predictive of computer use when the pedagogy of the teacher was taken into consideration. Those personal characteristics were: 1) teacher innovativeness; 2) computer relevance; 3) computer self-competence; and 4) subjective norms.

Methods and Procedures

To study the relationship between teachers' pedagogical beliefs and their level of computer use, data were collected from 101 classroom teachers. A composite questionnaire consisting of original and previously used items was administered to classroom teachers. Results were analyzed to determine if there was a relationship between the pedagogical beliefs of the teachers and the level of computer use they attained in their classrooms.

The Sample

Elementary teachers were chosen to study the relationship between teachers' pedagogical beliefs, personal characteristics, and computer use. Elementary teachers were chosen because they typically teach a variety of subjects. This was considered desirable in order to eliminate the possibility that teachers may choose to use or not use computers because of their perception that computers might be more useful for some

subjects and less so for other subjects. The precedent for using elementary teachers for this reason was established by Marcinkiewicz (1993, 1994).

In order to be included in the sample, teachers had to have at least two years teaching experience in an environment that provided access to computers. This stipulation was made to allow teachers time to establish competence in instructional computer use.

The school district from which the sample was drawn has equipped each second through fifth grade classroom with a bank of four or five computers attached to a network server. The server provided access to an integrated learning system (Jostens, 1990), a multi-media encyclopedia, desktop publishing, presentation programming, electronic mail and several word processing packages. Additionally, each computer was equipped with a floppy disk drive and thus could be run using a variety of educational software available in that media. This software mix was considered to be adequate to appeal to teachers holding a variety of pedagogical beliefs.

Instrumentation

The questionnaire used for the collection of data contained 57 items. These items assessed teachers' pedagogical beliefs, level of computer use, innovativeness, computer relevance, computer self-competence and subjective norms. Table 1 is presented as an overview of the variables included in the questionnaire. Additionally, information was collected relevant to seven demographic variables: age, gender, teaching assignment, grade level, teaching experience, computer experience and computer ownership.

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Table 1

Variables Assessed As Part of this Study

Variable	Origin	# of Items	Response Types
	Criterion Variable		
Levels of Computer Use	Original	5	6-point Likert Scale
	Independent Variables		
Pedagogy	Original	28	Select from a list
Perceived Relevance	Marcinkiewicz (1993, 1994)	1	6-point Likert Scale
Computer Self-Competence	Marcinkiewicz (1993, 1994)	1	6-point Likert Scale
Subjective Norms	Original	5	6-point Likert Scale

To assess teachers' pedagogical beliefs, three sets of items were included in the questionnaire. The first set, composed of 12 statements, assessed knowledge acquisition. Six of the statements expressed a behaviorist point of view. One such statement read, "Material should be presented in small steps which are mastered one at a time." The other six expressed a cognitivist point of view. An example was "The quality of the student's learning depends more on the thinking the student does than what is going on in the classroom." Respondents were to choose the six items that most closely matched their beliefs.

The second set of items assessed beliefs regarding the nature of knowledge. Again, 12 statements were presented, 6 expressing an objectivist viewpoint and 6 expressing a constructivist point of view. An objectivist statement was, "A correct answer exists for most questions." A constructivist statement was, "Students create knowledge as they attempt to make sense of their experiences." Teachers were asked to choose the 6 statements that most closely matched their beliefs.

The third set of items was in the form of four scenarios. Each scenario was composed of three statements on the same issue, one representing the behaviorist viewpoint, one the information processing viewpoint, and one the constructivist viewpoint. Teachers were asked to choose the statement in each scenario that most closely matched their viewpoint.

The pedagogical items yielded three scores for each respondent, a behaviorist score, an information processing score, and a constructivist score. Table 2 indicates how each score was derived. The behaviorist score was calculated by adding the number of behaviorist items selected from the first set of items to the number of objectivist items on the second set and the number of behaviorist items chosen from the scenarios. A high score of 16 was possible. This score could be achieved if the teacher chose all six of the behaviorist items, all six of the objectivist items and all four of the behaviorist conversational statements. In a similar manner, the information processing score was calculated by adding the cognitivist items from the first set, the objectivist items from the second set and the information processing statements from the scenarios. The constructivist score was calculated by adding the cognitivist items from the first set of

items, the information processing items from the second set and the constructivist items from the scenarios. A high score of 16 was also possible on both the information processing and constructivist scale.

Table 2

Scoring Procedures for Pedagogical Scales

Scale	=	Knowledge Acquisition Statements (set 1)	+	Nature of Knowledge Statements (set 2)	+	Scenarios (set 3)
Total Behaviorism	=	# of Behaviorist Statements selected (6 points possible)	+	# of Objectivist Statements selected (6 points possible)	+	# of Behaviorist Statements Selected (4 points possible)
Total Information Processing	=	# of Cognitivist Statements selected (6 points possible)	+	# of Objectivist Statements selected (6 points possible)	+	# of Information Processing Statements selected (4 points possible)
Total Constructivism	=	# of Cognitivist Statements selected (6 points possible)	+	# of Constructivist Statements selected (6 points possible)	+	# of Constructivist Statements selected (4 points possible)

To assess level of computer use, an original 5-item scale was administered. Respondents were asked to indicate their degree of agreement with statements designed to measure how integral the respondent viewed computers to achieving existing classroom goals. One such statement was "If I moved to a school where there were no computers, I would have to change the way I teach." A 6-point Likert response format was used. Teachers who were not using computers for instruction were directed to skip these items.

To calculate level of computer use, responses to each of the five items were totaled. Scores between 5 and 30 were possible. The higher the score, the more the teacher was indicating computers were being used at the integration level.

Teacher innovativeness was measured using a 10-item scale developed by Hurt, Joseph and Cooke (1977). The Innovativeness Scale was developed to measure the respondent's willingness to change. The instrument required respondents to make judgments about their innovative activity on a 6-point Likert scale. An innovativeness score was calculated by adding together the responses on each of the five items. Scores between 10 and 60 were possible. Higher scores indicated a higher degree of innovativeness. This scale was also used in the Marcinkiewicz (1993, 1994) studies.

Computer relevance was measured using a single item scale developed by Marcinkiewicz (1993, 1994). Respondents were asked to rate their agreement with an item stating that computers were relevant to teaching. The 6-point Likert scale was used to measure computer relevance. Scores between 1 and 6 were possible. Higher scores indicated a stronger perception that computers were relevant to teaching.

A single-item scale developed by Marcinkiewicz (1993,1994) was used to measure computer self-competence. Respondents were asked to rate their agreement with an item stating that they were capable of using the computer competently in their teaching. Teachers were asked to rate their perceptions on the same 6-point Likert scale. Scores

between 1 and 6 were possible with higher scores indicating that teachers perceived themselves to be capable of using the computer.

Subjective norms were measured using a 5-item scale. Subjects were asked in separate items about their perceptions of the expectations regarding computer use of significant others (i.e., their building administrators, district administrators, fellow teachers, students, and students' parents.) They rated their perceptions on the same 6-point Likert scale. This scale differed from the one used in the Marcinkiewicz (1994) study in that Marcinkiewicz used a single item including all significant others collectively. Separate items were used for each group of significant others to be more sensitive to the possibility that teachers would hold different perceptions about the expectations of each group of significant others. Scores between 5 and 30 were possible. Higher scores indicated that teachers had a stronger perception that instructional computer use was expected of the teacher by significant others in the educational setting.

Data Analysis

To determine if teachers hold pedagogical beliefs similar to the behaviorist, information processing, or constructivist positions, a descriptive approach was taken. The magnitude of the score the teachers received on each of the three pedagogical scales was considered. A prominent scale for each teacher was determined by noting the scale on which the teacher received the highest score. Sixteen was the highest possible score that could be attained on a prominent scale. A score of 16 indicated that the teacher selected all of the statements representing a single pedagogical viewpoint. The score of 12 was selected as an arbitrary cutoff point indicating that a respondent had views that

were closely aligned to one of the theoretical positions. The percentage of teachers who attained that level of alignment to a single pedagogy was calculated.

To determine if the difference in the level of computer use was related to the pedagogical orientation of the teacher, the data were examined in two different ways. First, a linear regression equation was computed to determine if pedagogical view was a predicator of level of computer use. Three separate regression analyses were performed, one for each pedagogical orientation.

The second way of examining data was by forming groups of those teachers whose scores represented an adherence stronger than that of their peers to each of the three pedagogical orientations. To do this, teachers whose scores on one of the three pedagogical scales were one standard deviation higher then the mean for that scale were assigned to a group representing that pedagogical orientation.

Mean scores on the level of computer use scale were calculated for each of the three pedagogical groups. Differences between mean scores of the groups were examined for significance by using a Kruskal-Wallis One-Way Analysis of Variance (KWANOVA). Tukey's Honestly Significant Difference Test was used as a post hoc analysis.

The third analysis involved determining whether the personal characteristics that were previously found to predict computer use remained predictive when teachers' pedagogical beliefs were taken into consideration. These personal characteristics included innovativeness, computer relevance, computer self-competence and subjective norms. The three groups representing teachers who had scored at least one standard deviation above the mean on each of the pedagogical scales were used to consider this

question. Regression equations were calculated for each of the three groups. The personal variables were used to predict level of computer use for each group. Differences between the slope and the intercept of each of the regression lines were examined for significance. In this study, equivalent linear regression lines for the three groups would mean that predictor variables had the same association with level of computer use regardless of pedagogical orientation of the teacher.

Results

The first question involved determining if the beliefs of teachers were closely aligned with a single pedagogical orientation. The results indicated that teachers did not select statements from a single pedagogical orientation. No one selected all of the statements from any of the three pedagogical orientations and only three respondents chose all but one or two statements from a single orientation. Categorizing as few as 19% of the teachers into groups representing their prominent pedagogical beliefs involved including teachers in a group even though they had rejected one quarter (4 of 16) of the statements associated with that belief system. Therefore, it was concluded that teachers tended to be eclectic in their pedagogical orientations.

Though eclecticism in pedagogical view was noted in the sample, a distinct tendency toward constructivism was demonstrated. Teachers chose more constructivist statements than statements representing the other two pedagogical positions. Teachers chose constructivist statements 928 times, information processing statements 849 times, and behaviorist statements 470 times. Of the 19% of the teachers who reached the criterion score of 12 and were considered to be closely aligned with one of the pedagogical views,

all but two were aligned with constructivism. Fifty teachers had constructivism as their prominent scale, 18 had information processing as their prominent scale and 10 had behaviorism as their prominent scale. The other 23 teachers had equally high scores on two of the scales.

When the relationship between pedagogical beliefs and level of computer use was considered, behaviorism was found to be a significant negative predicator of the level of computer use (*F Change =5.643, p=.019*). Neither of the other two pedagogical orientations was found to have a significant linear relationship with the level of computer use.

There was a significant difference between the mean ranks attained by each of the three pedagogical groups on level of computer use ($X^2 = 7.064$, $df = 2$, $p = .029$). Post hoc analysis indicated that in order to be significant at the $p \leq .05$ level, the difference observed between any two groups would have to be 12.35 or greater. Therefore the difference between the behaviorist group and the information processing group (12.54) was found to be significant. The difference between the behaviorist group and the constructivist group (10.69) approached, but did not reach significance. The difference between the information processing and the constructivist groups was quite small (1.82) and was not significant.

The personal variables as a group were shown to be significantly related to level of computer use (R^2 *Change =.508, F Change =11.11, df1=4, df2=43, p =.000*). Adding the pedagogical variables did not produce a significant R^2 change (R^2 *Change, =.22, F Change = .962, df1 =2, df2 = 41, p =.391*). There was not a significant interaction

between the pedagogical variables and the personal variables affecting the level of computer use attained by the three *groups* (R^2 *Change .092, F Change =1.00, df1=8, df2=33, p =.455*).

The variables that were most predictive of computer use were computer relevance (R^2 *Change = .198, F Change = 23.933, df1=1, df2 = 97, p = .000*) and subjective norms (R^2 *Change = .061, F Change = 7.914, df1 = 1, df2 = 96, p = .006*). Once these variables were entered into a regression equation, no other variables contributed significantly to the prediction of the model.

Conclusion and Discussion

The results supported the conclusion that although teachers tended to be eclectic in their pedagogical stance, their tendencies did seem to be related to the instructional decisions they made regarding computer use. Those teachers who held views that tended to be more behaviorist than their colleagues seemed to be least interested in using the computer for instruction. The stronger that stance was in favor of behaviorism, the less likely they were to use computers.

The results of this study suggested that the information processing group and the behaviorist group demonstrated the least similar patterns of computer use. This finding suggested that former research in which the teachers holding behaviorist and information processing beliefs were considered together under the "objectivist" umbrella may have masked important differences between the pedagogical beliefs of the two groups. Actually, it appeared that the beliefs teachers held concerning how knowledge is acquired were most predictive of the level of instructional computer use the teacher attained.

Thus, in future research, it may be most revealing to study computer use, and perhaps other instructional decisions, by considering pedagogical beliefs of teachers as a three category variable.

A second interesting finding of this study was the evidence that was provided that the teachers involved in this study exhibited tendencies toward constructivist beliefs. This finding was consistent with that of Scott and Hannafin (1996) suggesting teachers had a significantly more constructivist orientation than the parents of their students did.

The finding that the pedagogical variables did not add significantly to the prediction of the level of computer use that was possible using the personal variables suggested a co-linear relationship between the personal and pedagogical variables. Several interesting observations were evident in examining those relationships. Of the personal variables, only subjective norms were not significantly correlated with any of the pedagogical positions. Thus the perception that a teacher has about the expectations others hold for instructional computer use was not related to pedagogical beliefs. Computer relevance, computer self-competence and innovativeness were all negatively correlated with behaviorism and these correlations were significant. Both computer relevance and computer self-competence were significantly and positively correlated with information processing. Both innovativeness and computer self-competence were significantly and positively correlated with constructivism.

These correlations suggested that with regard to the personal variables, in many ways, teachers who were oriented toward information processing theory were more like their constructivist colleagues than their behaviorist colleagues were. This observation

lends further support to the suggestion behaviorists and information processing adherents should be separated when studying computer usage patterns.

Of all the variables, the two that were most predictive of computer use in this study were computer relevance and subjective norms. This finding was comparable to Marcinkiewicz's (1994) finding that once subjective norms were entered into the equation, none of the other personal variables contributed significantly to the prediction. However, unlike Marcinkiewicz's (1993) earlier work, where computer self-competence and innovativeness were shown to contribute to the prediction of the level of computer use, this study showed computer relevance offered the most toward the prediction. Perhaps this was due to the fact that, compared to the Marcinkiewicz (1993) study, many more of the teachers taking part in this sample had gotten beyond the utilization stage and were moving toward the integration stage. In both of the Marcinkiewicz (1993, 1994) studies, the samples were predominantly at the non-use and utilization stage. Perhaps teachers with higher levels of innovativeness were willing to try computers thus reaching the utilization level. But to become more deeply involved to reach the integration level, they must have a strong sense of computer relevance.

One cautionary remark must be made in regard to the interpretation of the findings of this study. One of the challenges of this study was to develop an instrument that would measure teachers' pedagogical orientations. To some extent, this attempt proved to be successful. However, some possible weaknesses of the instrument surfaced as part of the study. An examination of the individual items within the instrument revealed that there were three items representing the behaviorist/objectivist viewpoint that were chosen by

very few respondents. The results of this study did not provide sufficient information to conclude that these items discriminated between teachers with stronger alignment to the behaviorist/objectivist viewpoint and those whose orientation was less well aligned. It is possible that these items were ambiguous or otherwise unacceptable to most teachers. In that case, teachers who would normally have chosen a behaviorist/objectivist statement were forced to choose statements that did not reflect their belief system. This might account for the eclectic appearance of many members of the sample. In order to resolve this issue, this instrument should be revised using a parametric approach to item preparation. Further research with such an instrument has the potential to provide interesting and enlightening research concerning the relationship between pedagogical variables and instructional computer use. Perhaps such an instrument would also be useful in studying the relationship between teachers' pedagogical beliefs and many other instructional variables.

Another recommendation would be to pay more attention to the issue of software available to respondents. This study examined the relationship between pedagogy and computer use by ensuring that the respondents had equal access to an array of software that would support any of the three pedagogical orientations. The assumption was that, since a variety of software was available, each title was equally likely to be chosen depending on its appeal to the teacher's pedagogical orientation. Several unsolicited comments made on the questionnaire called that assumption into question. Several teachers made comments that indicated they equated computer use with the use of the integrated learning system. This notion may have stemmed from the uniform training

and support that was part of the implementation of the integrated learning system in the district from which the sample was drawn. This implementation may have given teachers the impression that the use of the integrated learning system was the expected mode of computer use.

The effect of this implementation may have been to depress the computer use of the constructivist teachers who may have viewed the objectivist nature of the integrated learning system as less relevant to instruction given their pedagogical beliefs. If constructivist teachers had been more fluent in their use of constructivist computer applications, more cognizant of how these applications could be used to achieve their educational goals, and believed that they were free to use these applications regularly as part of their instructional repertoire, the level of computer use scores of the constructivist teachers may have been quite different. Thus it would be informative to re-examine the relationship between pedagogy and computer use with other groups of teachers who have received more equal amounts of training in a variety of software applications.

In conclusion, the present study has contributed to the literature in several important ways. First, it has provided insight into the pedagogical beliefs of a group of practicing teachers. Second, it has provided the foundation for an instrument that will allow researchers to gain access to teachers' pedagogical beliefs. Finally, it has provided support for the notion that teachers' pedagogical beliefs can be considered to be a three category variable and that by so characterizing teachers, differences in their level of computer use can be related to their pedagogical beliefs. With this understanding an important area of research has been probed for the first time. Perhaps future researchers,

armed with a more powerful instrument, can bring further clarity to the relationship of pedagogical beliefs and computer use as well as other areas of teachers' instructional decision making.

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